REMARKS

Reconsideration is respectfully requested for claims 1-17 in view of the following remarks.

Claims 1-15 had been rejected under 35 U.S.C. §103(a) as being unpatentable over Paul et al. 5, 320,102 in view of Lang et al. 5,671,741. The Examiner alleges that Paul teaches all elements of the claims except for specifically teaching selecting one parameter, such as those defined in claim 2, and directly correlating the parameter with the biological property of the tissue. The Examiner alleges that Lang teaches the analysis of quantitative data from parameters, including those of signal intensity data, T1 and T2 relaxation times in order to statistically correlate the data with the biological property of necrotic tumor tissue.

This rejection is respectfully traversed.

First, it is noted that prosecution of this application has been somewhat disjointed. It is noted that in the Office Action mailed October 2, 2002, claims 1-15 had been rejected under 35 U.S.C. §102(b) over Paul et al. and that in response to the Amendment filed on February 13, 2003, the Examiner allowed all claims except 1-5 and 16 which were rejected solely under 35 U.S.C. §112 second paragraph. The rejection under 35 U.S.C. §112 was addressed in an Amendment mailed July 9, 2003. According to the PAIR records of the U.S. Patent and Trademark Office, a Notice of Allowability was then issued on August 11, 2003.

It is respectfully believed that claims 1-17 are clearly patentable under 35 U.S.C. §103(a) over the previously cited Paul et al. patent in view of newly-cited Lang 5, 671,741. Independent claim 1 specifies a method for analyzing tissue based on quantized magnetic resonance data using an MRI measurement acquisition system in which a magnetic resonance parameter is selected for characterizing tissue, and then a suitable pulse sequence is used to calculate and quantify the selected magnetic resonance parameter. Multiple sets of magnetic resonance signals are then acquired, and the magnetic resonance imaging parameters are calculated and quantified on a pixel-by-pixel basis for the multiple sets of magnetic resonance signals. Finally, biological properties of interest are determined by biological means including histological, biochemical, histochemical, and biomedical, and then the quantitative ranges of the selected magnetic resonance parameters are correlated with selected biological properties of interest.

More particularly, claim 16 specifies that calculating and quantifying the magnetic resonance imaging parameters on a pixel-by-pixel basis includes preparing a histogram plot of the frequency distribution of the parameter.

Additionally, dependent claims 4 and 5 specify creating a color image of the tissue based upon representation of sets of one or more quantitative magnetic resonanc parameters.

Apparatus claim 11 specifies magnetic resonance apparatus for use in analyzing a body comprising means for establishing a magnetic fields through the body, mean for exciting nuclei spins in the body, and means for receiving magnetic resonance signals from the excited nuclei representative of nuclei spins. Further, the means for exciting and means for receiving cooperatively obtain a multiplicity of sets of magnetic resonance signals and calculate a magnetic resonance quality from the body. Means is then applied for quantifying the magnetic resonance quality pixel-by-pixel within the body.

Dependent claim 15 further specifies in the apparatus a display for color imaging the magnetic resonance qualities pixel by pixel, and dependent claim 17 specifies that the means for quantifying prepares a histogram plot of the frequency distribution of the parameter.

This is in accord with the Summary of the Invention given on page 2 of the specification that the invention is directed to using magnetic resonance parameters in the diagnosis of and prognosis for damaged tissue. In describing a specific embodiment, the Summary of the Invention states that known MRI data acquisition techniques are employed to collect signal data on a pixel-by-pixel basis for use in calculating MRI parameter values, and the range of values for each magnetic resonance parameter can be color coded to provide a spatial map of pixels to provide a spatial picture of the quality of tissue.

While Paul et al. describe a method for diagnosing cartilage based on magnetic resonance image, and while Paul does utilize signal intensity which is weighted by T1 dependence, Paul does not teach **calculating** T1 parameter values or other parameter values specifically. Note Col. 4, line 52 which refers to the degree of T1 weighted dependence of **signal intensity**, Col. 9, line 56 which refers to a T1 weighted vector and Col. 10, line 5 which refers to factors that influence **signal intensity**. Indeed, claim 1 of Paul et al. refers to quantifying a **signal intensity** of a magnetic resonance image, and claim 12 refers to comparing a peak **signal intensity** of the **signal intensity** pattern. Thus, Paul et al. are using relative signal intensities, rather than actually calculating and quantifying magnetic resonance imaging parameters as specifically defined in claims 10-15 and 16-17.

Further, claims 4, 5, 9 and 10 all refer to creating a color image of tissue based on the determined magnetic resonance qualities, and nowhere does Paul et al. suggest the use of color imaging in displaying the tissue parameters, such as histograms of the parameters.

Accordingly, it is submitted that the method for analyzing tissue as defined by claims 1-10 and 16 and the magnetic resonance apparatus as defined by the claims 11-15 and 17 as now specifically defined, are neither shown nor suggested by Paul et al.

Lang is similar to Paul in the use a subjective analysis of **signal intensity** as an indication of T2 relaxation times. Note Col. 12, lines 16-45 that **signal intensity** at different tumor regions were graded high, intermediate, or low based on visual analysis. A histologic composition of the various high, intermediate, and low **signal intensity** areas were determined. Analysis of various models was used to analyze the quantitative signal intensity data, viable tumor demonstrated **high signal intensity** on T2 weighted imaged, and in T1 weighted images viable tumor showed a marked increase in signal intensity.

Thus, like Paul et al., Lang is using relative signal intensities, rather than actual calculated and quantified magnetic resonance parameters as in the claimed invention, to try and characterize tissue. Using a relative signal intensity is obviously a very subjective measure and much less accurate and dependable than the claimed invention. Accordingly, the invention of claim 1-17 is not shown or suggested by Paul et al. taken with Lang et al.

Claims 1, 2, 5-7, and 10-15 have been rejected under 35 U.S.C. §103(a) as being unpatentable under previously cited Ackerman et al. in view of Lang. Again, the Examiner alleges that Ackerman et al. teach the claimed invention except for specifically selecting one parameter and directly correlating the parameter with a biological property of tissue. The Examiner alleges that Lang teaches the analysis of quantitative data from parameters including those of signal intensity data T1 and T2 relaxation times in order to statistically correlate the data with the biological properties.

This rejection is believed to be in error with regard to claims 1, 2, 5-7, and 10-15. As described above, the claimed invention is directed to analyzing tissue based on quantized magnetic resonance data in which multiple sets of magnetic resonance signals from tissue are acquired and then magnetic resonance imaging parameters are calculated and quantified on a pixel-by-pixel basis. Claim 16 further specifies that the quantifying of the magnetic resonance imaging parameters on a pixel-by-pixel basis includes preparing a histogram plot of the frequency distribution of the parameter, and dependent claim 5 specifies creating a color image based on representation of sets of one or more of the quantitative magnetic resonance parameters.

While Ackerman et al. are concerned with calculating bone mineral density using magnetic resonance principles, Ackerman et al. utilize **image intensity** rather than actually calculating and quantifying the magnetic resonance quality from acquired magnetic resonance signals. Note for example Col. 10, lines 54-57 where Ackerman et al. describe mean pixel intensity over an entire image can be computed and then the image can be normalized on a pixel-

by-pixel basis with respect to mean pixel intensity. Thus, Ackerman is utilizing parameter-dependent intensities without actually calculating the parameters,

Further, Ackerman does not show or suggest creating a color image based on the representation of sets of one or more quantitative magnetic resonance parameters, as specified in claim 5, which can be based on a histogram plot of the frequency distribution of the parameter as specified in claim 16.

Method claim 1 and apparatus claim 11 have similar limitations in the obtaining and calculating of magnetic resonance qualities from a body and quantizing the magnetic resonance qualities pixel by pixel within the body.

Again, Lang is similar to Ackerman et al. and Paul et al. in using image intensity rather than calculated and quantified magnetic resonance quality from acquired magnetic resonance signals. All three references suffer from using subjective evaluation of signal intensity which results in inaccuracies in the tissue characterization.

Thus, it is believed that Ackerman et al. and Lang et al., singly or combined, neither show nor suggest the claimed method for analyzing tissue and the magnetic resonance apparatus for use in analyzing a body as defined by claims 1, 2, 5-7 and 10-15.

Claims 16 and 17 were not specifically rejected by the Examiner, but the foregoing analysis assumes that claims 16 and 17 were included in the rejections.

Since claims 1-17 are patentable under 35 U.S.C. §103(a) over Paul et al. in view of Lang, and since claims 1,2, 5-7, and 10-15 under 35 U.S.C. §103(a) over Ackerman et al. in view of Lang, all of the above set forth, it is requested that claims 1-17 be allowed and the case advance to issue.

Should the Examiner have any questions or suggestions regarding the present response, a telephone call to the undersigned attorney is requested.

Respectfully submitted,
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